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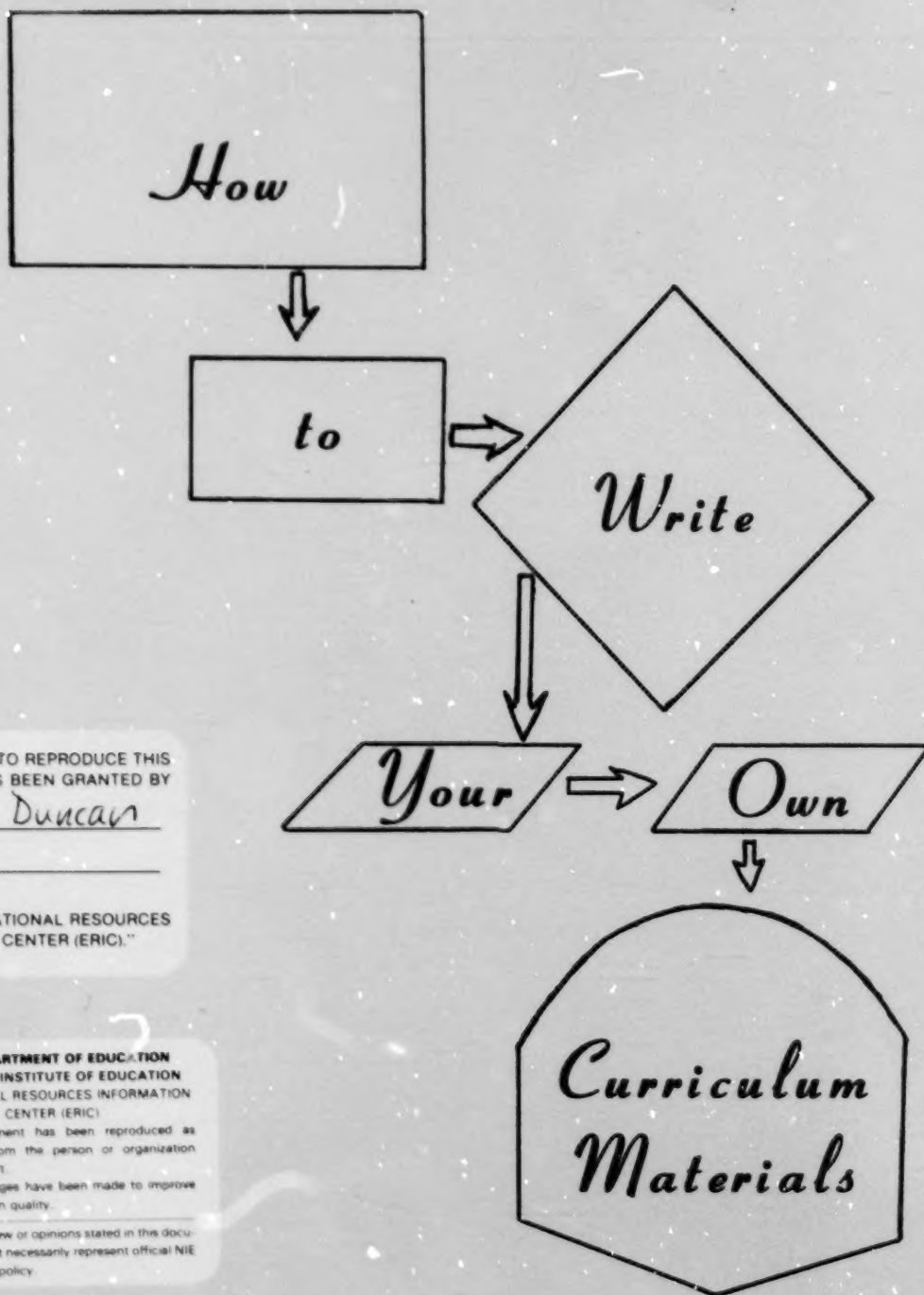
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ABSTRACT

Some techniques or strategies and principles of organization can make the teacher's task of modifying or writing curriculum materials easier. This monograph provides a step-by-step guide for writing curriculum materials, whether approaching the problem from scratch or modifying that which already exists. Chapter 1 provides the rationale, and chapter 2 discusses student learning levels, methods of instruction, and learning models. Chapters 3 and 4 describe techniques for developing units and single lessons within units. Specific topics include: behavioral objectives, readability formulas, and student evaluation. A publishing format is also provided. (JMK)

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HOW TO WRITE YOUR OWN CURRICULUM MATERIALS

by

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Revised, 1981

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INTRODUCTION

The most careful selection of published, student instructional material lacks the personalized style that teachers desire for their specific classrooms. Efforts to upgrade classroom instruction from a single text approach are time consuming. Yet, as teachers observe the effectiveness of their efforts in tailoring the learning experiences of students, they become increasingly convinced that modifying textbook learning is necessary for successful teaching. Accordingly, many teachers improvise by using readings from one text, a laboratory from another, and lectures and questions from a third. In other words, to provide depth, relevance, and quality for students of a particular class, teachers find it necessary to mesh several materials from a variety of sources.

Some techniques or strategies and principles of organization can make the task of modifying or writing curriculum materials easier. It is the purpose of this monograph to provide a step-by-step guide for writing curriculum materials whether approaching the problem from scratch or modifying that which already exists. The discussion of learning levels, methods, and modes of instruction in Chapter I describes the fundamental processes that every successful teacher incorporates into classroom instruction.

Successive chapters describe techniques for developing units and single lessons within units. The format for publishing is also provided.

It is our hope that this monograph will serve as an introductory guide to teachers for use in developing their own curriculum materials. No prior writing ability is necessary. The techniques and format for curriculum writing found within this monograph have been successfully used with teachers to prove that those interested in curriculum writing can succeed in doing so.

HOW TO WRITE YOUR OWN CURRICULUM MATERIALS

CHAPTER I

THE RATIONALE

Classrooms contain individuals with a diversity as great as that which exists within the community from which they come. As we move from one school to the next, one community to the next, one state to the next, we see no two classrooms alike. Even from one year to the next a teacher cannot expect teaching problems, needs, or opportunities to remain the same. Yet, for 5- to 7-year blocks of time, most teachers face the dilemma of organizing their programs around the same textbook and of basing a part of each student's evaluation on how well the student learns from that textbook.

Teachers often wish that they could reshape or rewrite their text materials to better suit their own unique classrooms. Some would even prefer to relegate the text to the status of a resource book, building their own curriculum around ideas and experiences that are especially meaningful and exciting for their particular students, both individually and as groups. Few teachers, though, have had the opportunity to acquire the skills necessary in preparing curriculum materials.

The objective of this monograph is to provide that opportunity for those teachers wanting to try. The monograph will be of use in several ways: (1) to individual teachers wishing to add special activities within an ongoing structure; (2) to individual teachers wishing to write a complete unit of instruction; (3) to teams of teachers working together over an extended period to develop new curricula or supplement an existing curriculum; (4) to inservice and preservice educators interested in helping teachers acquire skills in curriculum development.

CHAPTER II

FRAMEWORK FOR WRITING

Three basic assumptions underlie the approach herein outlined for preparing curriculum materials:

Students must be active participants in their own learning processes rather than passive absorbers of knowledge.

Teachers are more effective when they have a personal investment in the curriculum they teach and when they function as facilitators of learning rather than solely as imparters of knowledge.

Curriculum materials must be designed to accommodate and capitalize upon the diversities and complexities that exist within any given classroom and among different classrooms and schools.

Thus, when writing instructional activities, the writer-teacher must always be conscious both of the students for whom the material is intended and of the ways in which the activities are to be used.

The Learning Levels

In the development of instructional materials, one of the most crucial factors is how well these materials are suited to the individual student who will use them. Every class is filled with individuals, each beginning at a different level of understanding. Not only do students enter with different backgrounds and interests, they also come with varying degrees of readiness to learn the topic at hand. Thus, while one student may be totally without the skills needed to begin studying a particular principle, another may already have attained at least a cursory understanding of the principle; and a third may be competently applying the principle. Hence, in this context, learning level is used to refer to the types of intellectual processes required of the student by the activity as well as the level of cognitive development anticipated to result from the activity.

In order to make allowances for individual differences within the complex demands of the classroom, a four-level approach is required.

Level I: Skill acquisition--developing basic skills required to learn about and understand the principle.

- Level II: Application--applying these skills in studying and understanding the principle; e.g., through designing and implementing laboratory investigations.
- Level III: Problem-solving--using the principles learned and related skills to solve problems and discover new associations.
- Level IV: Experimentation--This fourth level of learning is a personal interaction between the individual and the subject matter. It requires a compilation of student questioning, an analysis of ideas, and a synthesis of past learnings which a student uses to answer questions generated by his or her own thinking. This level is reserved for students who have achieved a high level of mastery of the first three levels. Students would use this level to experiment with ideas developed from the first three levels of learning. These ideas would be open-ended, allowing the student to develop them into a project of indepth study.

This model pictures learning as a sequential process, beginning with very concrete skill experiences, progressing through concrete applications and manipulations, and leading to the formal reasoning of problem-solving and experimentation. A student without the necessary skills cannot be expected to achieve an understanding of the principle. Similarly, a student who does not have a clear understanding of the principle cannot be expected to solve problems which involve the competent use of that principle. As a matter of fact, it can also be argued that a principle has not been internalized until it can be used to solve or resolve problems. This is the ultimate test of a student's mastery of principles.

In each grade students should perform activities at the first three levels of learning. When a principle is introduced, a greater portion of their time must be spent acquiring the skills required to learn a principle. When they again study the principle, the skills need only be reviewed allowing more time for application of the skills as well as for the fundamentals of problem-solving.

Instructional materials, then, must be written in such a way that an appropriate balance among the first three levels is maintained. To accomplish this, each activity is designated as Skill, Application, or Problem-Solving. So that the purpose of the activity will remain clear, each activity should focus on only one of the three levels. Other levels should be reached through additional activities.

Through the technique of daily individualization, a student may be able to demonstrate competence quickly in a prerequisite skill and then move to a second activity which requires application of that skill to learn about the principle being studied. In this way a critical degree of individualization is introduced without taxing the teacher with the overwhelming problem of designing different activities for each child.

Methods of Instruction

Writing activities require thought as to how the skill or principle may be best presented. Four alternative ways of grouping students to facilitate their learning are suggested.

The *Individual Study Approach* has the advantage of allowing the teacher to work one-to-one with a student, thus becoming familiar with the individual student's unique strengths and deficiencies. Individualization also permits a student to study an item of particular interest or to pursue a topic to a greater depth. Assignments, however, must be extremely clear and precise to insure that the student will have a reasonable chance of success. Frequent oral directions from the teachers are often necessary, especially for a poor reader. Tape recorded or illustrated instructions are of great value.

A variation on individual assignments that is especially effective is the use of peers in helping-relationships. A student who has a requisite skill or who has gained a specific principle may be teamed with a student who has not yet reached those proficiency levels. Peer-tutoring is sometimes helpful in supporting individualization. Further, helping-relationships can be directed to cause students to value one another's differences in abilities and talent.

The special advantages of the individual study method include:

1. Allowing individuals to undertake learning tasks appropriate to their academic level, i.e., custom tailored learning for each individual;
2. Using current teaching materials which are available only in small quantities;
3. Encouraging the student to work at his or her own pace in an area of special interest;
4. Providing more personal understanding between pupil and pupil and between pupil and teacher.

The *Total Classroom Approach* (large group) brings the total group together. This method of instruction is most suitable for introducing a new topic of study and for summarizing a study unit. Lectures, field trips, films, demonstrations, dramatizations and role-playing, and some games are often suitable to large groups.

Special advantages to organizing into the large group include:

1. Efficiency in stimulating interest and in summarizing;
2. Efficiency in sharing demonstrations, films, guest speakers, and field trips; and
3. Building group cohesiveness.

The *Project Team Approach* is designed to focus small groups of students (four to six) on an assignment where success is best obtained from a group effort. Group reports, large scale construction projects, and in-depth environmental studies are examples of this method. One member of the team serves as a leader, but all members are held responsible for attaining the goals set forth in the task.

Special advantages to organizing into the project team include:

1. Effective group interaction toward accomplishing a goal,
2. Directed responsibilities for each team member,
3. Building team cohesiveness,
4. The experience of organizing separate materials obtained by each team member into a comprehensive project or report, and
5. A strong feeling of team accomplishment for a successful project.

The *Round Robin* method of instruction is a modification of the learning center concept. It requires that 3 to 5 short activities, dealing with the same concept or idea, be placed at various stations around the room with students moving from one to the next. Since it is a teacher-controlled method of instruction, the teacher must decide whether:

1. All students, individually or in small groups, are to work at all stations, rotating in response to a time limit set for completing work at each learning center;
2. Students moved individually at their own pace from center to center, possibly even choosing the centers they will visit;

Regardless of the format used, verbal instructions to the total class are necessary prior to beginning the Round Robin.

Special advantages of the Round Robin method follow:

1. Concrete, tangible, and/or limited materials may be used within a limited time and with a large number of students.
2. Students with a short attention span are stimulated to continue working for a longer period of time.
3. Individuals that become disruptive in a group can be isolated from each other.
4. Slow learners are not pushed beyond their abilities to do all activities.

The Learning Modes*

Variety in instructional approach is one of the keys to successful teaching. Every instructional technique or mode has a value when used appropriately. Yet, any one approach used exclusively will eventually leave students bored.

The use of a variety of modes in instruction seems to have at least two advantages. Alertness and interest are more consistently sustained between both students and teachers by offering the unexpected and by stimulating responses in different learning styles. In addition, variety allows more flexibility in presenting a topic, encouraging the viewing of that topic from different perspectives.

The learning modes can be classified into nine categories: presentation, simulation, questionnaire, personal interaction, laboratory, true-life experience, games, personal creation, and practice. This list provides manageable sets of alternatives from which a teacher can create a sizable "bag of tricks" to have at his or her fingertips. The list will probably stimulate the identification of more categories. However, categorization should not imply that any activity need be limited to any one category of modes. Indeed, blending modes from two or more categories is highly desirable in order to take full advantage of the variety.

Presentation

The Presentation is a fairly formal mode for conveying information to a learner. It is especially useful for integrating complex ideas and for developing an overall view. Its primary value, though, lies in presenting information that cannot be seen or done by the learner on his or her own and for focusing the learner's attention on particular points of interest or importance.

*Reprinted from Gadsden, T., Jr., "Modes of Learning," The Manitoba Science Teacher, Vol. XIX, No. 4, April, May, June, 1978, pp. 20-25.

Examples

- Films
- Demonstrations
- Lectures (presenting information, instruction, explanation, analogy)
- Readings (expository, historical, philosophical, critical)
- Narrated slides
- Television programs
- Audio tapes

Simulation

Simulation is a little used mode that is generally time consuming but highly involving. The role of the simulation is to engage the learner in an experience that approximates a real-life situation in which the learner could not or would not place himself because the real-life situation is inaccessible, too complex, or dangerous. Simulations are especially valuable for developing understanding of processes, interactions, and feelings.

Examples

- Simulation devices (e.g., airplane or automobile simulators)
- Computer simulation of experiments
- Role-playing a historical situation or natural phenomena (e.g., acting out situations analagous to specific historical events, the Coreolis Effect, or the operation of Electrical Circuits)
- Simulation games (such as the Pollution game, Extinction, or Redwood Controversy)

Questioning

Questioning directs the attention of the learner to particular aspects of a topic that may be especially important and will lead him to a clear understanding of the topic. The questioning forces the student to review information and form a response. It is characterized by a response from the learner (either oral, written, or non-verbal) and by a set of criteria for judging the adequacy of the response. The questioning mode also has the distinct advantage of providing an opportunity for feedback to both the teacher and learner concerning the adequacy of the learner's level of understanding of the topic.

Examples

Learner answering:

- Guide questions
- Problem-solving
- Programmed instruction
- Traditional testing

Learner questioning:

Written questions
Oral questions

Learner Evaluating Statement for Correctness or Adequacy

Personal Interaction

Personal Interaction involves more than one person in an open, informal exchange of information, opinions, and feelings. It requires a teacher to assume a position more nearly equivalent to the learner so that open interaction may occur. Yet, the teacher must also maintain control or establish a setting where the students establish and maintain standards of group behavior so that the interaction will involve all students in a non-threatening, supportive way. Either student or teacher may be the source of information, opinions, or feelings. And either student or teacher may be the learner within this learning mode category.

The roles of the learners include interacting, clarifying, supporting one another, eliciting discussion from each other, reaching a consensus. Participants establish a closer understanding of one another, leading to friendships, role modeling, and tolerance.

Examples

One-to-one or small group exchanges
Students teaching students
Inquiry discussions
Counseling groups
Interviewing
Tutoring

Laboratory

In the laboratory, learners interact with limited quantities of materials under controlled conditions. Though not particularly efficient, and fairly expensive, it does require involvement of the learner. The laboratory leads to improved rapport with technology, ability to control variables, and a better appreciation for scientific thought and attitudes.

The learner's role is to interact with the situation presented in such a way as to gain information about and understanding of the topic or problem. The learner can also become adept at many processes; e.g., manipulation of equipment, measurement, analysis, observation, and hypothesizing. A laboratory activity can be used to focus on any one of these processes or any combination of them while excluding others.

Examples

Pen and paper analysis:

- Analysis of data
- Development of hypotheses
- Data bank

Concrete manipulation of variables:

- Verification
- Experimentation
- Observation (of a limited situation)

Whole Body*

True-Life Experience

Informal, and often unstructured, the True-life Experience allows the learner to respond creatively to surroundings as he perceives them. It is a highly personal type of learning, whether the experience occurs alone or in a group. If properly arranged, the True-life Experience may be both relevant and motivating. The role of the learner is to observe, experience, internalize, consider, and act. As there is little or no control of variables, this type of learning is far more complex than a laboratory experience.

Examples

- Field trips (to observe the phenomena or processes that constitute our surroundings, such as visiting a farm, a court room trial, or a zoo)
- Involvement activities or projects (to give students an opportunity to either become a temporary part of these phenomena and processes or to examine them scientifically through activities such as ecological studies, work-study, or community involvement projects)
- Action (to effect change within one's surroundings or adapt to the surroundings; e.g., environmental or political actions)
- Introspection (into one's own feelings: Sitting alone by a waterfall or a seashore for an extended period can stimulate this kind of learning.)

Games

Games are fairly reasonable in both time and expense, and the payoff can be large. Learning may be obvious or incidental; in either

*The Whole Body Laboratory is a situation in which variables affecting the learner's own body are controlled and altered so that the learner personally experiences the situation rather than analyzing, manipulating, or observing it.

case, it does occur with relatively long-lasting effects. The role of the learner is to meet the challenges of the game through whatever learnings are acquired from the game. The role of the game is to provide the challenge and motivation to learn whatever is necessary to meet the challenge. This mode is excellent for learning processes and specific information, including vocabulary, and for correlating general concepts.

Examples

Competitive games:

- Hunts
- Team challenge games
- Board games

Non-competitive games:

- Crossword puzzles
- Puzzles
- Word searches

Personal Synthesis and Creation

Synthesizing learnings, and from that synthesis creating new communications, is one of the highest levels of learning as well as one of the most effective modes of learning. It is also among the most difficult modes to evaluate. Above all, it is personal and generally relevant to the learner-creator. The role of the teacher in this mode is to help the learner express himself without interfering in the creation. In evaluating the creation the teacher may be able to help the learner consider additional perspectives or probe more deeply into the implications of his own perspectives, using the personal interaction mode.

Examples

- Writing (poems, stories, plays, papers, critiques, summaries, lab write-ups)
- Speech making
- Producing media (films, slides, bulletin boards)
- Doing projects (displays, experiments)
- Creating games
- Creating works of art

Practice

Practice is the mode through which the learner becomes competent, confident, and skilled. The teacher directs the learner to what should be practiced and then guides the learner to be sure that he

or she is practicing correctly. Used almost exclusively by some teachers and rarely by others, this technique does have a useful and important role. Practice, followed by frequent application, enables the individual to develop the essential skills of communication, computation, observation, and manipulation necessary to operate successfully in other learning modes.

Examples

- Rote memorization
- Motor skill practice
- Behavior patterning practice

Combinations of Modes

Most instruction combines two or more modes. A complete experimental investigation, for example, should involve several modes in addition to the laboratory. Written and oral instructions (presentations), written guide questions (questioning), student manipulation of variables and observation of results (laboratory), teacher-student informal exchanges as the investigation progresses (personal interaction), the student's analysis of the results and writing of conclusions (personal synthesis and creation), and open class discussion of the meaning of the experiment (person interaction), may all be critical components of a single investigative activity. Another example, the value sheet, consists of a presentation (written or otherwise), questioning (about the content of the presentation, its relation to the topic being studied, the feelings it elicits, and the underlying values involved), and possibly personal interaction (in the form of an open discussion). The selection of appropriate modes and the innovative combination of modes is one of the more challenging and fascinating aspects of teaching, so long as the learning characteristics of students for whom they are intended are the primary criteria used for selection.

Summary of Levels, Methods, and Modes of Instruction

Learning Levels

- I. Skill acquisition
- II. Manipulation of equipment with use of skills - application
- III. Coordination of skill and manipulations to solve problems and discover new associations
- IV. Experimentation

Teaching Methods

- I. Large Group Instruction
- II. Project Team approach
- III. Round Robin
- IV. Individualization

Teaching Modes

- I. Presentation
 - a. filmstrips/film - reading
 - b. demonstration
 - c. lectures
 - d. guest speakers
- II. Simulation
 - a. involves learner in experiences analogous to real life - situation example: role playing, simulation gaming
 - b. simulation devices
- III. Questioning
 - a. guide questions
 - b. problems
 - c. testing
- IV. Personal Interaction
 - a. interviews
 - b. student teaching student
 - c. tutoring
 - d. surveying
- V. Laboratory
 - a. pencil and paper analysis
 - b. manipulation of variables
 - c. whole body
- VI. True-life Experience
 - a. field trips
 - b. probing the environment
- VII. Games
 - a. relays
 - b. card games
 - c. board games
 - d. body involvement
 - e. pass offs
 - f. hide and seek
 - g. puzzles
- VIII. Personal Creation
 - a. speech making
 - b. writing
 - c. producing media
 - d. displays of mobiles - bulletin boards
 - e. drama
- IX. Practice
 - a. rote memorization
 - b. motor skill practice
 - c. behavior patterning

CHAPTER III

THE WRITING PROCESS

An instructional unit consists of the following components:

1. Theme
2. Title
3. Objectives
4. Unit Outline or Flow Diagram
5. Teacher Notes (of supplies and materials, special preparations, etc.)
6. Activities arranged in the following manner:
 - a. Introduction
 - b. Body
 - c. Conclusion
 - d. Testing
7. Evaluation

When writing curricular materials, a theme, topic, or concept serves as a unifying focus. Each single activity deals with a specific part of the broad topic. When the unit is complete, individual activities tie together to form a cohesive block of materials on that topic, theme, or concept.

The objectives should be established prior to writing in order to identify the limits of the unit. However, the unit outline or flow diagram is more satisfactorily made after most activities are written. Completing the outline or flow chart after writing the individual activities serves as a method for determining if all objectives have been met and helps the writer in sequencing individual activities within the unit.

Throughout the writing of a unit, attention must always focus upon the reading audience, the students. The material should be important for students to learn, suitable for their age level, and written with a vocabulary and style that is engaging as well as readable.

When dealing with low achievers it is important to plan a larger time span for the activities and present these activities in a mode that is easy to understand for the level of students in the class.

Reading Levels

Curricular materials are often written at a reading level above the level of the students toward whom they are directed. It is

important, therefore, to carefully consider the reading level of the curricular materials that are developed. For many students, reading is the most difficult part of the assignment. Therefore, it is critical to provide the student with materials that are written at the student's level, not only in sentence and word structure but also in content level.

There are many formulas to determine the reading level or readability of written materials. Some formulas require considerable time to use in determining satisfactory estimations of reading levels. The number of variables involved can complicate the task. Fortunately, a few instruments are easy to use and take only minutes to obtain a fairly accurate determination of reading level for use by a curriculum writer. These formulas are based on the numbers of words per sentence and syllables per word.

Consideration must also be given to the level of difficulty of the material evaluated as a possible bias requiring adjusting the reading level determined with the formulas. For example, if a formula-determined reading level was seventh grade and the content concerned the chemical structure of DNA, the realistic reading level of these materials would be much higher.

The following three readability formulas were selected for their simplicity of operation. One of the formulas, the Fog Index, is designed to be used on a computer or microcomputer. It is written in the Basic Language so anyone with minimal computer knowledge will be able to program the computer and run the program. The SMOG Readability Formula requires some math calculations while the Fry Readability Formula uses a simple graph based on words per sentence and syllables per word. Following are examples of the three formulas.

Modified SMOG Readability Formula

Lawrence L. Smith
University of Florida

1. Count 10 consecutive sentences near the beginning of the text to be assessed, 10 in the middle, and 10 near the end.
2. In the 30 selected sentences count the words of three or more syllables. (Any string of letters or numerals beginning and ending with a space or punctuation mark should be counted if you can distinguish at least three syllables when you read it aloud in context. If a polysyllabic word is repeated, count it only once.)
3. Estimate the square root of the number of polysyllabic words counted. (This is done by taking the square root of the nearest perfect square.)
4. If the perfect square is 9 or less, the square root gives the adapted SMOG grade. If the nearest perfect square is 16 or greater, add one to the square root to determine the adapted SMOG grade.

See Table 1 to determine SMOG reading grade level.

TABLE 1
Determining Adapted SMOG Reading Grade Level

A			B
0	-	2	1
3	-	6	2
7	-	12	3 or 4
13	-	20	5
21	-	30	6
31	-	42	7
43	-	56	8
57	-	72	9
73	-	90	10
91	-	110	11
111	-	132	12
133	-	156	13

If the number of polysyllabic words is between (A) ,
then the readability level will be (B) grade.

Directions for Using the Fry Readability Graph

1. Randomly select three (3) sample passages and count out exactly 100 words each, starting with the beginning of a sentence. Do count proper nouns, initializations, and numerals.
2. Count the number of sentences in the hundred words, estimating length of the fraction of the last sentence to the nearest one-tenth.
3. Count the total number of syllables in the 100-word passage. If you don't have a hand counter available, an easy way is to simply put a mark above every syllable over one in each word; then when you get to the end of the passage, count the number of marks and add 100. Small calculators can also be used as counters by pushing numeral 1, then push the + sign for each word or syllable when counting.
4. Enter graph with average sentence length and average number of syllables; plot dot where the two lines intersect. Area where dot is plotted will give you the approximate grade level.
5. If a great deal of variability is found in syllable count, basing the average on more samples is desirable.
6. A word is defined as a group of symbols with a space on either side; thus, Joe, IRA, 1945, and & are each one word.
7. A syllable is defined as a phonetic syllable. Generally, there are as many syllables as vowel sounds. For example, stopped is one syllable and wanted is two syllables. When

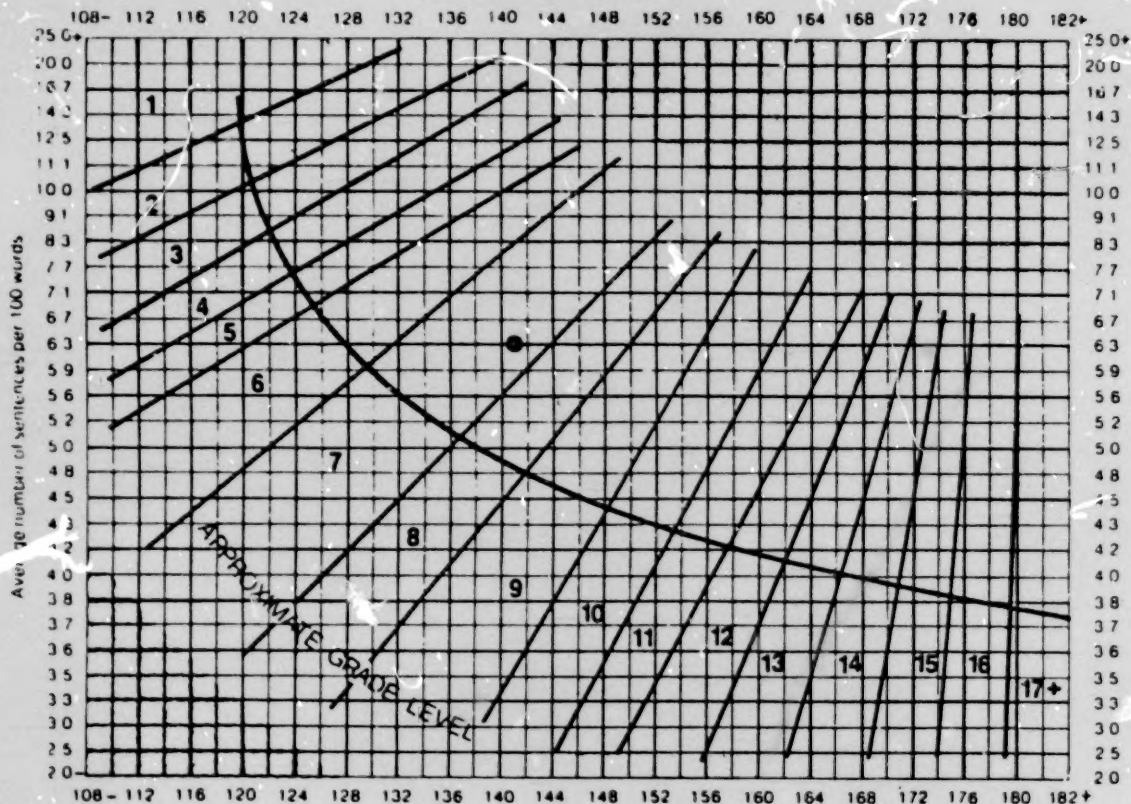
counting syllables for numerals and initializations, count one syllable for each symbol. For example, 1945 is four syllables, IRA is three syllables, and & is one syllable.

FRY READABILITY FORMULA

GRAPH FOR ESTIMATING READABILITY - EXTENDED

by Edward Fry, Rutgers University Reading Center, New Brunswick, N. J. 08904

Average number of syllables per 100 words



"Fog Index" Readability Program

This computer program is designed to give an approximate reading grade level indication for any article, book, or magazine.

The *Fog Index* gives the approximate reading level by school grade. As written, the program averages the reading level of five sentences to give a score to the material. This can be used in two ways. The index can be used to indicate an overall readability or a level of difficulty which applies to understanding more technical material.

To determine overall readability choose a typical section of a book, article, or letter and count the total number of words and number of words over two syllables in five consecutive sentences. These data will be entered into the computer to give an overall readability score for the article.

For more technical material, choose the five most difficult sentences of the material. Enter the number of words and number of three syllable and larger words into the computer. This test tells how hard it is to understand the material completely. The test is more important for government regulations, for a small misunderstanding can get you into big trouble.

What do you do with it? If you are writing, you should try to keep your Fog Index well below the level of the average reader but high enough so that the material is not boring. Perhaps the most difficult of the popular magazines, the Atlantic Monthly, is written at a twelfth grade level. For this monograph and for teenage and young adult readers, a Fog Index of 8 is appropriate. (Lest you think that writing on the eighth grade level is demeaning, the Revised Standard Version of the Bible presents the Sermon on the Mount at the eighth grade level.)

This program is written in the Basic language for the Radio Shack TRS-80 microcomputer. But the program can be used with any computer that uses the Basic Language.

```
10 CLS
20 PRINT@ 64, "FOG INDEX"
30 PRINT: PRINT "THIS PROGRAM WILL RATE PRINTED MATERIAL ON HOW"
40 PRINT "EASY IT IS TO READ. TO USE IT, PICK FIVE TYPICAL"
50 PRINT "SENTENCES AND ANSWER THE QUESTIONS GIVEN."
60 DIM A(10):REM * OMIT THIS LINE FOR LEVEL I BASIC *
70 PRINT: PRINT: INPUT"(PRESS ENTER TO BEGIN)";A$
100 CLS
110 FOR A=1TO5
120 PRINT "NUMBER OF WORDS IN SENTENCE NUMBER";A;
130 INPUT A(A)
140 PRINT "NUMBER OF 3 OR MORE SYLLABLE WORDS IN SENTENCE NUMBER";A
150 INPUT A=A+5
160 NEXT A
170 B=0: FOR A=1TO10:B=B+A:A=0: NEXT A
180 CLS: F=B*.4
190 PRINT INT(F/5);"IS THE FOG INDEX"; PRINT
200 PRINT "THE FOG INDEX IS ABOUT THE SAME AS GRADE LEVEL"
210 PRINT: PRINT "TYPICAL VALUES"
220 PRINT "17 COLLEGE GRADUATE (NO POPULAR MAGAZINE IS THIS HARD)"
230 PRINT "12 HIGH SCHOOL SENIOR - ATLANTIC MONTHLY"
240 PRINT "10 HIGH SCHOOL SOPHOMORE - TIME MAGAZINE"
250 PRINT "8 EIGHTH GRADE - LADIES HOME JOURNAL - SERMON ON THE MOUNT"
260 PRINT
270 INPUT "(PRESS ENTER TO RESTART PROGRAM)";A$
280 GOTO 100
```

Two-Column Objectives

After your audience has been identified and a theme selected, then unit objectives for students must be formulated. The two-column

objective technique is advantageous in providing the framework for establishing both broad and specific student objectives. This technique is aptly named, as it places the broad objectives for the entire unit on the left side of the page, and the more specific objectives leading toward attainment of each broad objective on the right side of the page, thus forming two columns.

The format for writing two-column unit objectives looks something like this:

Your primary objectives in studying this unit are to:

1. Develop your ability to . . .
2. Increase your understanding of . . .

You can show you are making progress toward these objectives by:

- 1a. Distinguishing between . . .
- 1b. Writing an analysis of . . .
- 2a. Identifying three . . .
- 2b. Explaining to your teacher how . . .
- 2c. Demonstrating how you would . . .

Notice that the objectives are written in learner terms. They are intended to be read and used by the learner and to show that the learner has the major responsibility for learning and for attaining these objectives. The unit test should be tied directly to these objectives so that the learner will know what is expected and, on that criteria, his learning will be evaluated.

Learning is never a completed task. No one can ever fully understand any given topic. But we can strive to reach as far as we are able toward the goal of understanding. Thus, two-column objectives are written as progress objectives toward an unobtainable goal.

In the left column, the objectives outline the goals toward which students should strive in studying a particular theme. The objectives in the right-hand column give students mile posts at which they can check their progress. Nowhere do these objectives imply to students that once they have accomplished specific end-point objectives they have learned all they need to know about the topic.

In writing two-column objectives, one begins by identifying in the broadest sense the most important learnings associated with the chosen topic. They should be few in number (so that students are not overwhelmed), important, clearly stated in learner terms, and

representative of growth that is expected in all students. A reasonable number of objectives seems to be from two to six. Students would, of course, be encouraged to learn other things in addition to those included in the objectives. These "other things", however, may be different for different students. The decision of which broad objectives to exclude and include is difficult and requires consideration of the needs and nature of your students and of your program objectives.

The attainment of each broad objective is then broken into discrete, measurable steps that can be accomplished by your students. The left-hand objectives could be the same for any group of students, but the right-hand objectives must be adjusted to the backgrounds and interests of the students using the materials. Again, two to six seems to be a reasonable number of specific objectives for each general objective. These objectives are written in behavioral terms to facilitate measurement and recognition by students of their own progress.

Both the left- and right-column objectives should reflect more than one domain of learning (i.e., cognitive, affective, and psychomotor) and aim toward all levels of the domains as much as possible.

The objectives provide the structure for the unit. Activities must be constructed that will help students attain each of the right-hand objectives. If no activities can be found, the objective should be deleted. It will probably be necessary to move back and forth from activities to objectives many times--polishing, deleting, adding, and rewriting as you go.

A sample set of objectives is found in Table 2.

TABLE 2
Unit Objectives

Unit Title: Beaware!

Theme: Awareness

Your primary objectives in studying this unit are to:

1. Develop your understanding of the concept of awareness.

You can show you are making progress toward these objectives by:

- 1a. Listing six major levels of awareness.
- 1b. Recognizing or describing examples of each level of awareness.
- 1c. Evaluating a definition of awareness.
- 1d. Identifying types of detail reported in an observation.

TABLE 2 (continued)

<u>Your primary objectives in studying this unit are to:</u>	<u>You can show you are making progress toward these objectives by:</u>
	1e. Giving an example of an inference and an observation relating to the same object.
2. Recognize factors that affect awareness.	2a. Listing the body's sense organs and the sensations they receive.
	2b. Describing a limitation of each sense.
	2c. Analyzing the report of an observation to determine what factors might have affected it.
3. Increase your observational skills.	3a. Reporting observations that consistently used two or more of your senses.
	3b. Demonstrating skill in observing and reporting observations at the four basic levels of awareness.
	3c. Using tools appropriately and accurately to extend your senses.
4. Become increasingly aware of your surroundings.	4a. Expressing the needs for critical awareness.
	4b. Describing accurately details of your daily environment, both from memory and direct observation.
	4c. Increasing the quantity and quality of your observations of ordinary conditions.
	4d. Identifying and describing interrelationships existing among living things; among non-living things; and among living and non-living things.

Single Activities

Single activities are the student's daily assignments by which the unit content is learned. Each single activity should:

1. Provide for student involvement,
2. Use simple equipment which students can manipulate safely,
3. Provide for a basic reading skill or limit the amount of reading, or support the reading with diagrams and pictures that would communicate much of the reading materials,
4. Explain new and difficult terms simply.

The format around which the writing of scientific materials should consistently be organized is that of the scientific method. It provides a process for clear, logical thinking and for the accurate solution of problems. Students using activities which have been written using the scientific method are helped to think logically, clearly, and in an organized fashion. (See "Steps in the Scientific Method".)

Therefore, the focus of this guide is to help the would-be writer develop materials to get the student actively involved in their own learning. Test materials can be modified from existing tests or created to fit the activities after the unit materials have been developed.

Steps in the Scientific Method

Purpose:	The object of the assignment is usually stated as: to describe, to test, to observe, to identify.
Materials:	Equipment needed is listed and complex set-ups are presented in a drawing.
Procedure:	How to conduct the experiment is described in step-by-step detail.
Hypothesis: (optional)	An educated guess is made of what the experimenter thinks will happen.
Results:	What happened in the activity or what was observed is recorded. Results may be recorded in the form of a graph, chart, drawing, or statement(s) to be completed.
Conclusion:	What happened (results) is interpreted. It usually takes the form of a statement or paragraph(s) relating back to the purpose and explaining results.

Development of the Single Activity

1. Refer to texts or reference materials to gain a complete overview and understanding of the idea to be developed.
2. Determine the most exciting, most unique, different approach for teaching your students the single idea.
3. Structure each activity so that the student is accountable for what he is doing.
4. Write all sentences clearly with a limited length.

Purpose:

Phrase the purpose (objective) into a readable, single-idea sentence.

Materials:

List materials needed. Make a drawing of any "fancy" lab set-ups.

Procedures:

Outline in a clear, simple, step-by-step fashion telling how the students are to go about doing the activity.

Results:

Tell student what is expected; e.g., make a chart or a graph; give an explanation of an observation; to answer several questions about what happened.

Conclusions:

Ask students specific questions or ask for statements that will focus the ideas of the activity into a decision, opinion, or judgment of what the work has shown.

Teacher Notes

While teacher notes can be written after each single activity, they should be revised after a class of students has tested the activity. Thus, the teacher will reflect on the real problems or conditions needed to successfully use the activity.

In writing a unit of single activities, the writer will want to create activities of the following types:

- Introductory
- Body or main content
- Concluding
- Testing

Introductory activities will be limited to a few. Their function is to stimulate interest in the topic, present a broad scope of the theme, or lead into the idea with a novel approach.

Most of the activities of the unit will be concentrated within the body or main content. These activities will be varied in their levels, methods of grouping students, and modes. Concluding activities will serve to summarize the unit or tie it together in some fashion so that the total activity is pictured for the student.

Testing activities hold the student accountable for learning. These single activities must be written to test for student gain in knowledge. This activity type may take many forms and be used as little or as often as the teacher-writer desires. It is suggested that a novel approach for student evaluation be utilized whenever possible to stimulate student effort.

Be sure to write additional single activities as needed to fill in gaps in the learner's background knowledge, and to modify the two-column objectives, flow diagram, or unit outline as needed. When writing objectives, the following lists of general first-column (left-hand) objectives with the adjacent behavioral terms for the right-hand column should be useful (see Tables 3 through 5).

TABLE 3

Examples of General Instructional Objectives and Behavioral Terms
for the Cognitive Domain of the Taxonomy

Major Categories in the Cognitive Domain	Illustrative General Instructional Objectives	Illustrative Behavioral Terms for Stating Specific Learning Outcomes
1. KNOWLEDGE	Knows common terms Knows specific facts Knows methods and procedures Knows basic concepts Knows principles	Defines, describes, identifies, labels, lists, matches, names, outlines, reproduces, selects, states

TABLE 3 (continued)

Major Categories in the Cognitive Domain	Illustrative General Instructional Objectives	Illustrative Behavioral Terms for Stating Specific Learning Outcomes
2. COMPREHENSION	Understands facts and principles Interprets verbal material Interprets charts and graphs Translates verbal material to mathematical formulas Estimates future consequences implied in data Justifies methods and procedures	Converts, defends, distinguishes, estimates, explains, extends, generalizes, gives examples, infers, paraphrases, predicts, rewrites, summarizes
3. APPLICATION	Applies concepts and principles to new situations Applies laws and theories to practical situations Solves mathematical problems Constructs charts and graphs Demonstrates correct usage of a method or procedure	Changes, computes, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses
4. ANALYSIS	Recognizes unstated assumptions Recognizes logical fallacies in reasoning Distinguishes between facts and inferences Evaluates the relevancy of data Analyzes the organizational structure of a work (art, music, writing)	Breaks down, diagrams, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, points out, relates, selects, separates, subdivides
5. SYNTHESIS	Writes a well organized theme Gives a well organized speech Writes a creative short story (or poem, or music) Proposes a plan for an experiment Integrates learning from different areas into a plan for problem-solving Formulates a new scheme for classifying objects (or events, or ideas)	Categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes
6. EVALUATION	Judges the logical consistency of written material Judges the adequacy with which conclusions are supported by data Judges the value of a work (art, music, writing) by use of the internal criteria Judges the value of a work (art, music, writing) by use of external standards of excellence	Appraises, compares, concludes, contrasts, criticizes, describes, discriminates, explains, justifies, interprets, relates, summarizes, supports

TABLE 4

Examples of General Instructional Objectives and Behavioral Terms
for the Affective Domain of the Taxonomy

Major Categories in the Cognitive Domain	Illustrative General Instructional Objectives	Illustrative Behavioral Terms for Stating Specific Learning Outcomes
RECEIVING	Listens attentively Shows awareness of the importance of learning Shows sensitivity to human needs and social problems Accepts differences of race and culture Attends closely to the class-room activities	Asks, chooses, describes, follows, gives, holds, identifies, locates, names, points to, selects, sits erect, replies, uses
RESPONDING	Completes assigned homework Obeys school rules Participates in class discussion Completes laboratory work Volunteers for special tasks Shows interest in subject Enjoys helping others	Answers, assists, complies, conforms, discusses, greets, helps, labels, performs, practices, presents, reads, recites, reports, selects, shares, studies, works
VALUING	Demonstrates belief in the democratic process Appreciates good literature (art or music) Appreciates the role of science (or other subjects) in everyday life Shows concern for the welfare of others Demonstrates problem-solving attitude Demonstrates commitment to social improvement	Completes, describes, differentiates, explains, follows, forms, initiates, invites, joins, justifies, proposes, reads, reports, selects, shares, studies, works
ORGANIZATION	Recognizes the need for balance between freedom and responsibility in a democracy Recognizes the role of systematic planning in solving problems Accepts responsibility for his own behavior Understands and accepts his own strengths and limitations	Adheres, alters, arranges, combines, compares, completes, defends, explains, generalizes, identifies, integrates, modifies, orders, organizes, prepares, relates, synthesizes

TABLE 4 (continued)

Major Categories in the Cognitive Domain	Illustrative General Instructional Objectives	Illustrative Behavioral Terms for Stating Specific Learning Outcomes
5. CHARACTERIZATION BY A VALUE OR VALUE COMPLEX	Displays safety consciousness Demonstrates self-reliance in working independently Practices cooperation in group activities Uses objective approaches to problem-solving Demonstrates industry, punctuality, and self- discipline Maintains good health habits	Acts, discriminates, displays, influences, listens, modifies, performs, practices, proposes, qualifies, questions, revises, serves, solves, uses, verifies

TABLE 5

Examples of General Instructional Objectives and Behavioral Terms
for the Psychomotor Domain of the Taxonomy

Taxonomy Categories	Illustrative General Instructional Objectives	Illustrative Behavioral Terms for Stating Specific Learning Outcomes
(Development of categories in this domain is still underway)	Writes smoothly and legibly Draws accurate reproduction of a picture (or map, biology specimen, etc.) Sets up laboratory equipment quickly and correctly Types with speed and accuracy Operates a sewing machine skillfully Operates a power saw safely and skillfully Performs skillfully on the violin Performs a dance step correctly Demonstrates correct form in swimming Demonstrates skill in driving an automobile Repairs an electric motor quickly and effectively Creates new ways of performing (creative dance, etc.)	Assembles, builds, calibrates, changes, cleans, composes, connects, con- structs, corrects, creates, designs, dismantles, drills, fastens, fixes, follows, grinds, grips, hammers, heats, hooks, identifies, locates, makes, manipulates, mends, mixes, nails, paints, sands, saws, sharpeners, sets, sews, sketches, starts, stirs, uses, weighs, wraps

The Unit Development

Series of single activities are the main basis of a unit since they are the day-to-day materials which students use to gain knowledge of concepts. It is only after most of the activities are written that the unit takes its form; reflecting the unique flavor which the teacher-writer has maintained throughout the majority of activities.

The theme and two-column objective should again be reviewed as the series of single activities are structured into a flow chart or sequenced into an activity list.

Once the individual activities are written, the flow diagram or unit outline is established in much the same way that a jigsaw puzzle is put together. Having all the parts available, simply decide where the single activities best fit for continuity and clarity in support of student learning.

The methods used for unit development are:

1. Flow chart method
2. Objective-Activity method
3. Modular method

The flow chart method requires the writer to place the activities in a sequence or flow pattern indicating the activity flow from the first activity to the final evaluation or activity. Most of the activities in the flow sequence depend on completion of the previous activity. The activities are developed around two-column objectives discussed earlier in the monograph. Figure 1 illustrates the flow chart method of unit development.

The objective-activity method uses the two-column objectives as the basis for the flow of the material development. Activities are written for the specific or right-hand column objectives reflecting back on the general objective in the left-hand column.

The two-column objectives are first written and then activities are designed to fit the right-hand column objectives. Table 6 illustrates the objective-activity method of unit development.

In this method, if space allows, the specific right-hand column objective could be written to the far right of the page to show the activity based on the general objective and the specific objective.

Title: Tilt

Theme: Equilibrium--Physical Basis for Balance

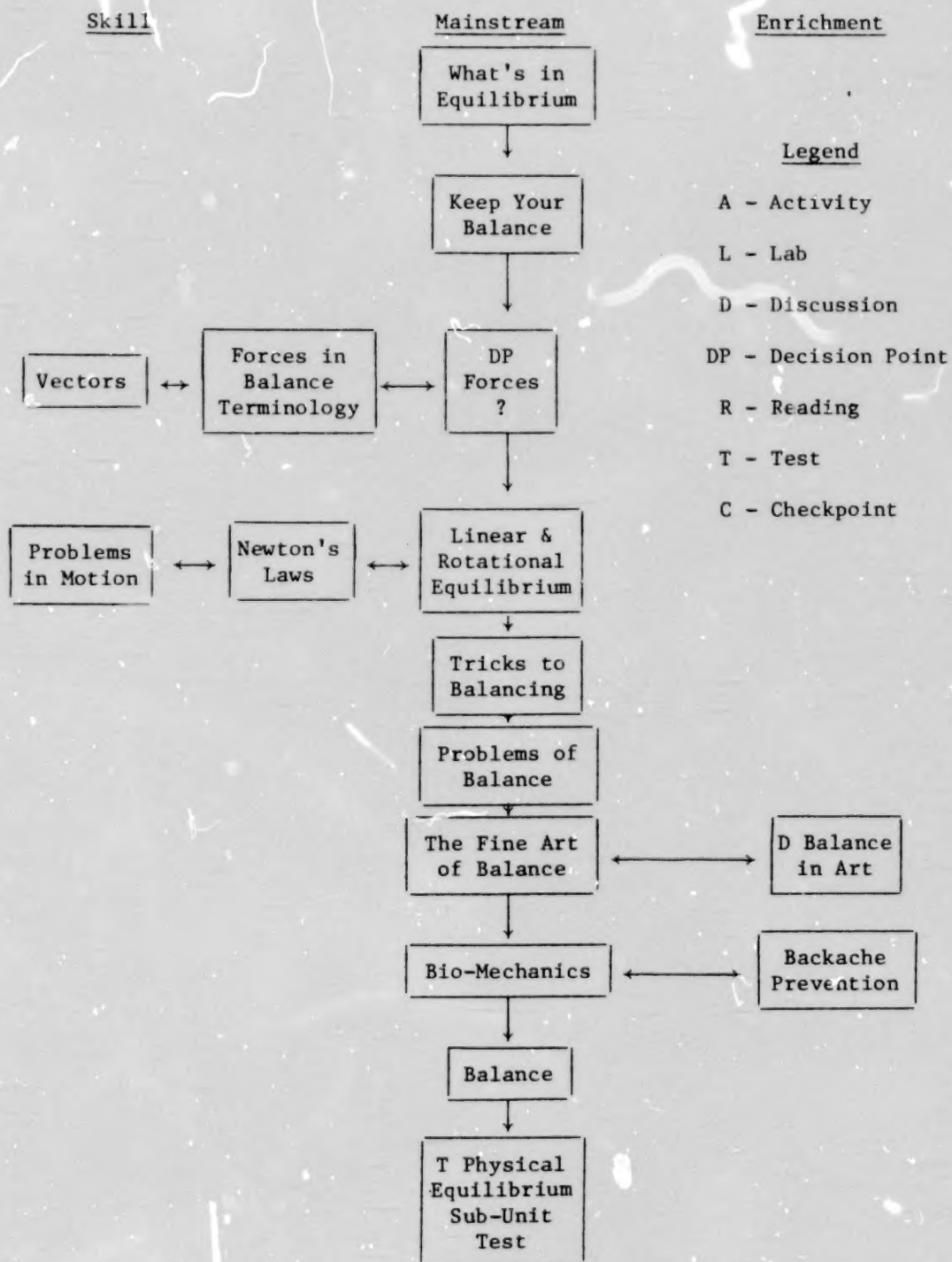


Figure 1. Flow Chart Method of Unit Development.

TABLE 6
Activity List with General Teaching Objectives
Characteristics of Living Things
Plant Classification

Objectives	Activities
1. To establish the characteristics of life.	1. A reaction of the living and non-living <u>Readings on Oxidation</u> 2. Life Activities 3. Activity Spin
2. To distinguish plant characteristics from animal characteristics.	1. Likeness & Difference 2. Cell Construction 3. Living Things are Alike 4. Plant and Animal Difference
3. To become familiar with the technique of classifying.	1. Grouping 2. Keys are for Unlocking 3. How Classifying Began 4. Origins of Classification
4. To become acquainted with the non-vascular plant groups.	1. Teacher Notes on Non-Vascular Plants 2. Teacher Notes on Bacteria <u>Readings on Bacteria</u> 3. Charting Bacteria 4. Sorting Bacteria (a game) 5. Nitrogen-Fixing Bacteria 6. Staining Your Own Bacteria <u>Readings on Algae</u> 7. Teacher Notes on Algae 8. Charting Algae <u>Readings on Fungi</u> 9. Teacher Notes on Fungi 10. Charting Fungi 11. The Structure of Mushrooms 12. Spore Prints 13. Respiration of Yeast 14. Growing Bread Mold <u>Readings on Lichens</u> 15. Teacher Notes on Lichens 16. Charting Lichens <u>Readings on Mosses & Liverworts</u> 17. Teacher Notes on Mosses and Liverworts 18. Charting Mosses & Liverworts 19. Non-Vascular Relay 20. Non-Vascular Crossword 21. Non-Vascular Selection
Bacteria	
Algae	
Fungi	
Lichens	
Mosses & Liverworts	
Evaluation	

The modular method of unit development has become increasingly more popular in the past few years as observed by the amount of modular materials now available for classroom use. This method uses objective development around a common theme. The general objectives need not follow in sequence, and, in fact, the general objectives in most modular units are related only to the theme. An introductory module is developed to introduce students to the concepts to be learned in the unit. Then a number of independent alternative modules are written, centered on the theme and concepts presented in the generalizing module but independent of one another. These modules may have more than one activity and these activities within a module may be dependent on each other.

A generalizing module is then needed to pull the student back to the original theme by unifying the concepts presented in the alternative modules to the theme. The unit evaluation occurs after the generalizing module. Figure 2 illustrates the modular method of unit development.

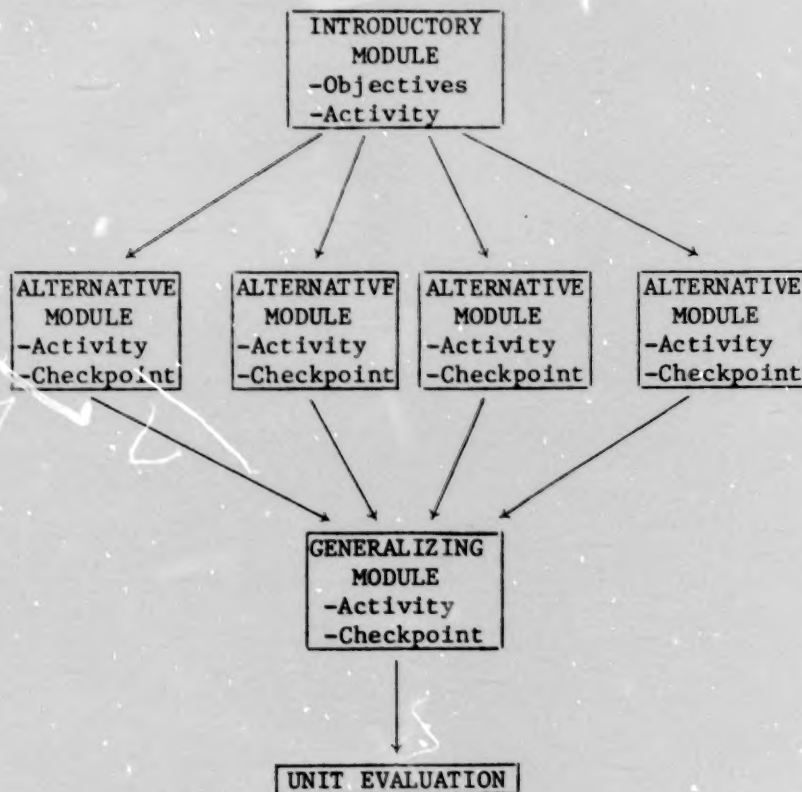


Figure 2. Modular Method of Unit Development.

Evaluation

Be sure to re-read each activity, making sure that every aspect is clear. Give the activity to a class of students to try out and then ask for student comments after the activity is performed by the class. Revise, or eliminate, the activity based upon student comments. Write, or revise, "teacher notes" to accompany each student-tested activity.

It is imperative that adequate evaluation be done in order to provide adequate and functional materials for the student, and a smooth, useful set of objectives and materials for the classroom teacher. Rating sheets are necessary for the evaluation process and should cover all aspects of the developed materials, from the cover sheet to student evaluations. Following are two evaluation formats useful in evaluating developed units. The first one, Table 7, is a questionnaire type evaluation that can be very useful when minimum time is available for evaluation and rewriting. Table 8 illustrates a record type of unit evaluation designed for multiple rewrites and careful section-by-section evaluation. It will be well to remember that the most important unit evaluation is the field evaluation where materials must stand up to the acid test of the classroom teacher and students. Be sure to keep in mind, during the unit evaluation, that time required of the teacher to prepare an activity is equally as important as time required by the student to complete the activity.

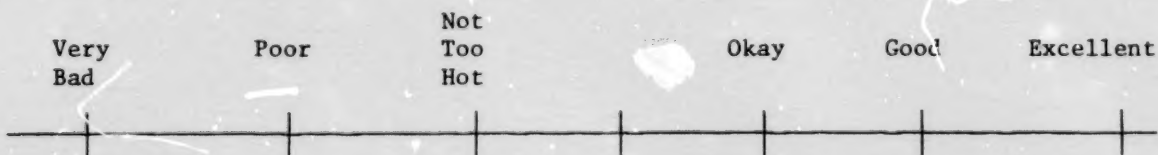
TABLE 7

Unit Evaluation Questionnaire

Instructions: Do not put your name on this evaluation. Its purpose is to improve the unit you have just completed. In answering these questions, please refer to the "Activities List" for this unit.

1. What specific activity do you feel was most successful?
2. From what specific activity do you feel you learned the most?
3. What specific activity "turned you on" the most?

4. Were there any activities that hindered your learning? If so, what specific activities were they and why did each of them hinder your learning?
5. What specific activities would you definitely change?
6. What changes would you make in the activities listed in question 5?
7. Are there any activities or kinds of information that you feel need to be added to the unit? If so, what?
8. Check the area on the scale below that best indicates your opinion of the unit.



9. Why did you rate the unit as you did in question 8?
10. What grade do you feel you deserved (or did you receive) on this unit?
11. Other comments--
-

TABLE 8
Modular Unit Development Record

Unit Title _____	
Author _____	
Rating by Version (0 = missing, 1 = low, 5 = high)	
	Draft 1 2 3
	Date _____
 1. COVER	
a. - theme	a _____
b. - title	b _____
c. - author and collaborators	c _____
d. - grade level	d _____
e. - duration	e _____
f. - development time	f _____
g. -	g _____
 2. INTRODUCTION	
a. - rationale	a _____
b. - reading level	b _____
c. - expectations of learners	c _____
d. - grading plan	d _____
e. - teacher's role	e _____
f. - coordination	f _____
g. - module preview listing	g _____
h. - materials list	h _____
i. -	i _____
 3. OBJECTIVES	
a. - clarity	a _____
b. - reading level	b _____
c. - appropriate for intended learners	c _____

		Draft	1	2	3
d. - number	d				
e. - related to program objectives	e				
f. - importance	f				
g. - mix of types	g				
h. - mix of levels	h				
i. -	i				
4. MODULE SELECTION					
a. - mix of contexts	a				
b. - mix of modes	b				
c. - concrete experience	c				
d. - difficulty range	d				
e. - relevant to unit objectives	e				
f. - learner interest	f				
g. - number	g				
h. - feasibility	h				
i. - local resource(s) incorporated	i				
j. - reading level range	j				
k. - lengths	k				
l. - "content" respectability	l				
m. - materials list	m				
n. -	n				
5. MODULE GUIDE SHEETS					
a. - reading level	a				
b. - functional for learners	b				
c. - sources(s) identified	c				

		Draft	1	2	3
d. - "other" learnings	d				
e. - appropriate checkpoints	e				
f. -	f				
6. EVALUATION					
a. - test items keyed to objectives	a				
b. - mix of test item levels	b				
c. - learner feedback	c				
d. - answer key	d				
e. -	e				
7. GENERAL					
a. - legibility and clarity	a				
b. -	b				

Summary of the Writing Process

This section contained discussion about:

1. Interpreting reading levels of materials through the use of:
 - a. An adapted SMOG readability formula
 - b. Fry readability formula
 - c. "Fog Index" readability program
2. Two-Column objectives for structuring a unit into:
 - a. Broad objectives in the left-hand column
 - b. Specific objectives in the right-hand column
3. Single Activities format using:
 - a. Steps found in the scientific method
 - b. Teacher notes
 - c. Different types of single activities
 - d. Illustrative terms for writing single activities
4. Unit development from three different styles including:
 - a. Flow chart method
 - b. Objective-activity method
 - c. Modular method
5. Evaluation techniques for determining the suitability of materials from:
 - a. The student's point of view
 - b. The writer's criteria

CHAPTER IV

WRITING CURRICULUM MATERIALS: DO IT YOURSELF

Now is the time for you, the reader, to become the writer! In the following pages, a series of materials is given and space provided for information to be completed. It is the aim of this section to guide the beginning writer through some of the critical steps in becoming an independent curriculum writer.

Theme Selection

If you have a theme, topic, or concept already in mind, proceed to the next page to begin. However, if you are still seeking an idea, examine the list below, or other sources, and establish a theme around which to develop curriculum materials.

Unit Theme Listing*

INTELLECTUAL PROCESSES OF SCIENCE

Classifying	Hypothesizing	Predicting
Communicating	Identifying Variables	Questioning
Controlling Variables	Inferring	Using Numbers
Defining Operationally	Interpreting Data	Using Space-Time
Designing Experiments	Measuring	Relationships
Formulating Models	Observing	

MAJOR CONCEPTS OF SCIENCE

Cause-Effect	Interaction	Replication
Change	Invariance	Resonance
Cycle	Matter-Energy	Scale
Entropy	Model	Significance
Equilibrium	Orderliness	Space-Time
Evolution	Organism	Structure-Function
Field	Perception	Symmetry
Force	Population	System
Fundamental Entities	Probability	Theory
Gradient	Quantification	Validation

PHENOMENA APPLICABLE TO UNIFIED SCIENCE

Any body of water	Rocks - Soil
Sun - Moon - Celestial Bodies	People
Volcanoes - Earthquake	Trees
Ice - Rain - Snow	Fire - Heat
Smog - Smoke	City

PERSISTENT PROBLEMS APPLICABLE TO UNIFIED SCIENCE

Land Use	Flooding	Distribution of Resources
Consumerism	Highway Maintenance	Finding One's Way
Erosion	Food Supply	Interpersonal Relationships
Weathering	Disease	Crime
Transportation	Bio-Engineering	Welfare
Population Control	Communications	Technological Impact

*Reprinted from the Center for Unified Science Education.

The following pages contain a format to be filled in as a practice for a unit development activity. Carefully complete as much as you can reflecting back to the post pages for help with two-column objectives, themes, and flow diagrams. As you complete a section, read on to the next section. Upon completion of this series of self-guided activities, you should be ready to take the big step--writing your own unit.

Unit Title _____

Theme _____

Estimated Duration _____

Audience _____

Two-Column Objectives
(Student Objectives)

You may want to refer to Table 2 on page 19 for a sample of two-column objectives.

Your (the student's) primary objectives in studying this unit are:

You (the student) can tell if you are making progress toward the primary objectives when you are able to:

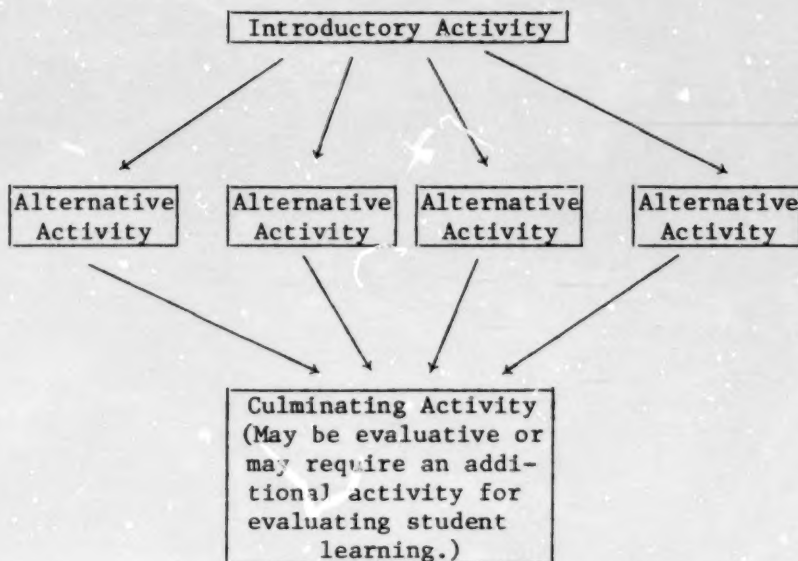
- | | |
|----|-----|
| 1. | 1a. |
| | 1b. |
| | 1c. |
| | 1d. |
| 2. | 2a. |
| | 2b. |
| | 2c. |
| 3. | 3a. |
| | 3b. |
| | 3c. |
| 4. | 4a. |
| | 4b. |
| | 4c. |

Try to vary the objectives to incorporate more than one domain for learning and several different learning levels within each domain.

A set of single activities focusing on a specific theme composes the unit. Recall that single activities are designed for specific parts of the unit. To channel your ideas and to provide a framework for completing the total unit, we are using the FUSE modular unit format. As you identify potential activities, fill in the titles in the appropriate boxes in the diagram below.

Unit Flow Diagram

Activity ideas to be filled in by the writer:



In writing objectives, it is essential that you list all of the general objectives you intend to use. However, do not get bogged down as you write specific objectives. It is perfectly all right to go on and begin to identify alternative activities for the general objectives and then return later to the specific objectives. In this way, you can revise and polish both the selection of objectives and of activities.

Having the framework of ideas for the unit, it is now time to proceed with the writing of the single activities that will compose the unit. This section is designed to help you through each of the component parts of an activity including:

Purpose
Materials
Procedure
Hypothesis
Observations
Results
Conclusion

Practice in Rewriting Purpose Statements

One of the most critical and difficult aspects of writing a single activity is to state the purpose clearly.

The purpose is a description of what the student is to accomplish through doing the activity. It is not a statement of what the activity is to do. The purpose should be clear, direct, and generally limited to a single idea. Even with older students the purpose should be kept to a single idea if possible. If more than one purpose must be included in an activity, be sure they are clearly delineated, such as (a), (b), etc. The purpose must also be directly tied to one (or more) of the specific objectives for the unit. Objectives and purposes are not identical. Several activities with different purposes may be used to attain a single objective. They may sometimes have similar wording.

Prior to writing a purpose, examine the poorly written ones below and identify what is wrong with each one. Compare your ways for rewriting each purpose with those comments given in the suggested corrections for purpose statements.

Poorly Stated Purposes

1. Purpose: To provide situations in which students must use metric measurements.
2. Purpose: To identify the four basic food groups and to conduct a survey of 50 people to find out how many eat the four basic foods on a daily basis and how their eating habits affect the way that they feel during the day.
3. Purpose: To find out the lengths of your classmates' mouths.
4. Purpose: To enunciate several hypotheses concerning techniques for the separation of a complex mixture of sands into graduated sets on the basis of coarseness.
5. Purpose: To teach students how to determine if mass and density of solids change.
6. Purpose: To expand the curriculum to include the study of weather.

Suggested Corrections for Purpose Statement

1. Poorly Written Purpose Statement.--*To provide situations in which students must make or use measurements.*

Suggested Corrections.--As written, this statement tells what the activity hopes to do. In addition, it is too vague for a purpose. It would be much better to clearly identify those situations that the student is to measure.

Purpose: *To measure the length of 8 objects in centimeters, decimeters, millimeters, and meters.*

or

Purpose: *To convert the tennis court measurements into meters.*

or

Purpose: *To measure distances between given cities in kilometers.*

2. Poorly Written Purpose Statement.--*To identify the four basic food groups and to conduct a survey of 50 people to find out how many eat the four basic foods on a daily basis and how their eating habits affect the way that they feel during the day.*

Suggested Corrections.--There are 3 different purposes within this one. They should be separated.

Purpose 1: *To categorize foods into the 4 basic food groups.*

Purpose 2: *To conduct a survey of 50 people to find how many eat the four basic foods each day.*

Purpose 3: *To identify how eating habits affect (influence) the energy level of a person.*

3. Poorly Written Purpose Statement.--*To find out the length of your classmates' mouths.*

Suggested Corrections.--This purpose seems trivial unless it is clearly connected to the unit objectives. To give it some use, it might be changed to:

Purpose: *To determine the amount of facial muscle stretch, measure the length of a person's mouth in a smile and no-smile position.*

4. Poorly Written Purpose Statement.--*To enunciate several hypotheses concerning techniques for the separation of a complex mixture of sands into graduated sets on the basis of coarseness.*

Suggested Corrections.--The terminology in this purpose is ridiculous. Remember to keep sentences clear and readable as students will feel greater success if they can understand what is expected of them. It would be necessary for this purpose to be totally rewritten in clear cut, specific terms such as:

Purpose: *Describe 3 different methods for separating a mixture of sands on the basis of their coarseness.*

5. Poorly Written Purpose Statement.--*To teach students how to determine if mass and density of solids change.*

Suggested Corrections.--This purpose potentially deals with two entirely different activities and is stated in terms of what the teacher wants to do--to teach.

6. Poorly Written Purpose Statement.--*To expand the curriculum to include the study of weather.*

Suggested Corrections.--This is a teacher objective and should be an idea to serve as the basis for a unit. From this topic, a series of two-column objectives should be formed and single purposes for the student developed.

The examples provided from Gronland's book may help you to clearly state the activity purpose.

Step-by-Step Process for Writing An Activity

The activity format described below is prescriptive, designed to help the beginning writer with the standard, basic aspects of an activity. With experience, the writer will develop specific styles and variations of his own to serve a particular writing audience.

Purpose: (Write the purpose for activity #1 in clearly stated terms.)

Materials: (List all equipment needed to accomplish the above-stated purpose.)

Procedure: (Detail in a step-by-step process how the activity is to be completed.)

Hypothesis: (This is an optional part of an activity. It should only be included if it will encourage or strengthen the thinking of the student. For example, if students have had little experience with pendulums other than to know what they are, it will strengthen their learning to hypothesize such things as: *Which will swing faster, a long pendulum line or a short pendulum line? or Which will have a greater swing, light or heavy weight on the pendulum?*)

Observations: (optional) If a student is manipulating equipment or living things, then observations may well be a part of the activity. Examples of observations:

1. Record the temperature change each $\frac{1}{2}$ minute for 3 minutes.
2. Count the number of times a particular person smiles each minute during a fifteen-minute period.

Sometimes the observations and the results are the same, in which case the section can be titled "Observations/Results", or just "Results".

Example: Survey 100 persons to determine the number who brush their teeth before breakfast. The student is interviewing 100 persons, but he is asked to record only one number--the number that brush their teeth before breakfast. This differs from true observations, such as those above where a series of records is to be made.

Does this activity have an "Observations" or "Observations/Results" section? If so, state what the observations are to be.

Results: (What happened in this activity or what was observed? Here the writer may ask for a graph, chart, drawing, or statement to be completed.)

Conclusion: This is frequently the most difficult part of the single activity for a student to complete. For young students, or for students of any age who have had little experience in interpreting results, it may be necessary for the writer to formulate concluding questions. Eventually, as students are trained, or as several activities have been discussed, students will begin to understand that conclusions of an activity focus the results into a decision, opinion, or judgment about what the activity was trying to prove. For more advanced students, their written conclusions should include:

1. A summary of the results of the investigation;
2. Possible sources of error that might have influenced these results;
3. An interpretation of the results and their implications with respect to the purpose;
4. New questions raised as a result of this investigation or other investigations that could be undertaken to gain additional information about the topic.

For example: Each member of a class of thirty students was asked to survey 50 persons to determine what brand of toothpaste was most used. The 1500 responses were tallied for the class on the chalkboard. Brand X was found to be used by an overwhelming number of persons surveyed. When asked what conclusions could be made from the survey, students responded with:

1. It's advertized most often on T. V.
2. The grocery store displays it in the most obvious and accessible places.
3. Dentists give free samples of that brand which then promotes the purchasing of that toothpaste brand.
4. That toothpaste is the "best" toothpaste on the market.

Here the teacher asked for a definition of the term "best" which started another series of conclusions:

1. It tastes better than other brands.
2. It prevents more cavities than other brands.
3. It foams better than other brands.
4. It makes teeth whiter than other brands.

The writer must help the student to understand the function of the conclusion either by questions, teacher directed discussion, or some other appropriate means.

After an activity has been written, re-read it for clarity and content. Then give the activity a title and set it aside for a day or two before checking it again.

At this point a "teacher note" for the activity may be written. The "teacher note" should address requirements or techniques necessary to make the activity a success. If no special requirements seem indicated, then do not write a "teacher note" until after the activity has been used by a class of students.

You are now on your way to writing a unit. Continue writing the single activities which you designated on the unit flow diagram. Use the appropriate learning levels (skill, application of skills, and problem-solving); include a variety of different learning modes (simulation, questioning, laboratory, personal creation, etc.) and different teaching methods (individualization, team project approach, large group, or round robin).

The Culminating Activity

The function of the culminating activity is to tie the unit together, summarize, and evaluate student learning of the unit.

A series of ideas is presented to the writer for creating this culminating activity. The ideas are:

1. A literature search paper
2. A personal creation or project from students
3. A simulation game
4. Dramatization of unit ideas
5. Bulletin Boards using unit ideas
6. A debate
7. Field trip
8. Laboratory Research Project
9. A checkpoint or test

Evaluating the Student

Evaluating the student is a critical part of the unit. It should be done throughout the unit either by a series of check points (tests) based upon the activities completed by the student, by the success exhibited by the student on individual activities, or by a combination of both of these methods.

The culminating activity can serve as one method for evaluating the student, but for certain types of units a teacher-made test may be more desirable for measuring student achievement.

Evaluating the Unit

Some units may require an evaluation activity following a culminating activity. When the single activities have been accumulated to meet each objective within the two-column framework and the unit flow diagram is complete, a flow chart or unit outline can be made. (See Figure 1, page 28, for flow chart and Table 6, page 29, for activity arrangements.)

As the outline or flow diagram is being developed, the writer should determine if every idea is clearly presented. If there are areas where student understanding of the topic seems incomplete, then additional activities should be written to complete the explanation of the theme. Remember that reading material from existing textbooks can serve to enhance student learning after the student has begun to participate actively in his own learning process.

Finally, to evaluate the unit of written materials, try them with a class of students. Make careful observations on each activity (student enthusiasm, clarity, ease of student understanding); discuss the activity with individual students at many achievement levels or with the class as a whole.

If modifications are needed or teacher notes need expanding, do it immediately or make clear written notes as to what should be done later.

CHAPTER V

SUMMARY

The writing process described in this monograph is built upon a foundation of theory and experience in teaching that ascribes to the belief that students should be more actively involved in their own learning processes. The authors of the monograph feel that a teacher is more effective as a facilitator of learning rather than as an impartor of knowledge.

Materials developed by a teacher should produce a measurable output from every student. It is hoped that this monograph will serve as a catalyst for stimulating teachers to develop student activities that will help make the learning process for students more satisfying.

The monograph may be of use in several ways: (1) to individual teachers wishing to add special activities within an ongoing structure; (2) to individual teachers wishing to write a complete unit of instruction; (3) to teams of teachers working together over an extended period to develop new curricula or supplement existing curricula; (4) to inservice and preservice educators interested in helping teachers acquire skills in curriculum development.

The Do It Yourself section provides a format for helping the individual to write using:

1. Theme selection
2. Two-column objectives
3. Unit flow diagram
4. Practice in rewriting purpose statements
5. Step-by-step process for writing an activity
6. The culminating activity
7. Evaluating the student
8. Evaluating the unit